

REMARKS

Favorable reconsideration of this application, in light of the preceding amendments and following remarks, is respectfully requested.

Claims 22 and 23 are pending in this application. Claim 22 is amended. No claims are added or cancelled. Claim 22 is the independent claim.

Rejections under 35 U.S.C. § 103

Lee in view of Chang and Seidl

Claim 22 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,844,604 to Lee et al. (hereinafter “*Lee*”) in view of U.S. Patent No. 3,996,021 to Chang et al. (hereinafter “*Chang*”) and U.S. Publication No. 2002/0014647 to Seidl et al. (hereinafter “*Seidl*”). Applicants respectfully traverse this rejection for the reasons detailed below.

The Examiner alleges that *Lee* teaches a capacitor of a semiconductor device comprising a lower electrode; an AlO(Al_xO_y) film 14 formed on the lower electrode; an upper electrode formed on the AlO film; and a dielectric film 14 having a dielectric constant that is higher than that of the AlO film between the upper electrode and the AlO layer, wherein the dielectric film is an HfO₂ layer, a ZrO₂, or an STO layer, and wherein the dielectric film is directly in contact with the upper electrode (since the first layer is an HfO₂ dielectric film, see column 2, lines 66-67).

The Examiner admits that *Lee* does not teach using an AHO ((Al_xHf_{1-x})O_y) film. However, *Chang* allegedly teaches using an AHO film instead of AlO film (col. 6, lines 33-50) and *Seidl* teaches in figure 1n and related text a capacitor comprising a lower electrode 60, an AHO film 70 formed on the lower electrode, and an upper electrode 80 formed in direct contact with the AHO film. Therefore, the Examiner

states that it is obvious to a person of ordinary skill in the art at the time the invention was made to replace the AlO film in *Lee*'s device with an AHO film in order to improve the device characteristics. Applicants respectfully disagree.

In addition to the deficiencies of *Lee* admitted to by the Examiner, Applicants respectfully submit that *Lee* does not teach or suggest a lower electrode formed on a semiconductor substrate as recited in amended claim 22.

Further, *Lee* does not teach or suggest a dielectric film having a dielectric constant that is higher than that of the AHO film between the upper electrode and the AHO film as recited in claim 22. Referring to column 6, lines 49-54 and FIG. 1B of *Lee*, first and second dielectric layers 18 and 20 are sequentially stacked on a substrate 10. The first layer 18 is a HfO₂, ZrO₂, Ta₂O₃ or Y₂O₃ layer, rather than an AHO (AlHfO) layer as recited in claim 22, but also, the second layer 20 is a AlO or HfO₂ layer, rather than a dielectric layer having a dielectric constant larger than that of the first layer as recited in claim 22. *Lee* discloses that a dielectric constant (k=10) of AlO is smaller than that of a dielectric constant (k=30) of HfO (see Col. 7, lines 21-26). Accordingly, a dielectric constant of the first layer 18 is equal to or larger than that of a dielectric constant of the second layer 20. In other words, a dielectric constant of the second layer 20 is not larger than that of the first layer 18 as is recited in claim 22.

The Examiner states in the Response to Arguments section that the materials for the first and second layers are interchangeable based on column 7, lines 23-24 which state that layer 20 can include HfO₂. However, Applicants respectfully submit that this appears to be a typographical error as the rest of that paragraph (lines 20-22 and 25-29) state that the total thickness of the second layer 20 is preferably not more than one third of the total thickness high-k dielectric layer 14 and the thickness of

Al₂O₃ is preferably approximately 33% of the total thickness of the high-k dielectric layer to achieve minimization of net fixed charge and a high dielectric constant of not less than k=20. As such, Applicants submit that one of ordinary skill in the art would not have been motivated to modify *Lee*'s capacitor to include the AHO layer of *Chang*.

In addition, an AlO layer of *Chang* is a material for coating a surface of an article, not a dielectric layer (see col. 2, lines 44-64), and *Chang* does not disclose a capacitor and/or a material for dielectric of a capacitor. Accordingly, although *Chang* discloses an AHO layer as a surface oxide layer that is more stable than an AlO layer (Col. 6, lines 40), one of ordinary skill in the art would not have been motivated to modify *Lee*'s capacitor to include the AHO layer of *Chang*, because the second layer 20 of *Lee* can't be replaced with the AHO layer of *Chang*.

If the second layer 20, the AlO layer, of *Lee* was replaced with the AHO layer of *Chang*, *Lee* would disclose a capacitor in which a lower electrode, the first layer 18, the second layer 20 (AHO layer of *Chang*) and an upper electrode are sequentially stacked, and therefore, the upper electrode would be in direct contact with the AHO layer (the second layer 20) rather than the dielectric film as recited in claim 22. As a result, the combination of *Lee* and *Chang* would not teach or suggest the capacitor including a dielectric layer which is provided between an AHO layer and an upper electrode and has a dielectric constant larger than that of the AHO layer as recited in claim 22. See MPEP 2143.01 "If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification". *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

Applicants submit that *Seidl* also fails to cure any of the aforementioned deficiencies of *Lee* and *Chang*. For all of the above reasons, *Lee*, *Chang* and *Seidl*, whether alone or in combination, fail to render obvious the limitations of claim 22.

The Applicants, therefore, respectfully request that the rejection to Claim 22 under 35 U.S.C. § 103(a) be withdrawn.

Conley in view of Chang and Seidl

Claim 22 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,930,059 to Conley, Jr., et al. (hereinafter “*Conley*”) in view of *Chang* and *Seidl*. Applicants respectfully traverse this rejection for the reasons detailed below.

In FIG. 5d and related text, the Examiner states that *Conley* teaches a capacitor of a semiconductor device comprising a lower electrode; an AlO (Al_xO_y) film 144 formed on the lower electrode; an upper electrode formed on the AlO film; and a dielectric film 143 having a dielectric constant that is higher than that of the AlO film between the upper electrode and the AlO layer, wherein the dielectric film is an HfO₂ layer, a ZrO₂, or an STO layer, and wherein the dielectric film is directly in contact with one electrode.

However, the Examiner admits that *Conley* does not teach using an AHO ((Al_x,Hf_{1-x})O_y) film, and does not explicitly state that the dielectric film is directly in contact with the upper electrode, but *Chang* teaches using an AHO film instead of AlO film (col. 6, lines 33-50). *Seidl* allegedly teaches in Figure 1 and related text a capacitor comprising a lower electrode, an AHO film formed on the lower electrode, and an upper electrode formed in direct contact with the AHO film.

Therefore, the Examiner contends that it is obvious to a person of ordinary skill in the art at the time the invention was made to replace the AlO film in *Conley*'s device with an AHO film and to form the dielectric film in direct contact with the upper electrode, in order to improve the device characteristics and in order to use the capacitor in an application which requires specific electrode positioning, respectively. Applicants respectfully disagree.

Conley discloses a dielectric layer structure which is formed by alternatively depositing hafnium oxides 143 and 143' and aluminum oxides 144 and 144' on an active area of a substrate 141. The Examiner alleges that the aluminum oxides 144 and 144' in the dielectric layer structure can be replaced with *Chang*'s AHO film. However, as described above, an AlO layer of *Chang* is a material for coating a surface of an article, and *Chang* does not disclose a capacitor and/or a material for dielectric of a capacitor. Accordingly, although *Chang* discloses an AHO layer as a surface oxide layer that is more stable than an AlO layer (Col. 6, lines 40), one of ordinary skill in the art would not have been motivated to modify *Conley*'s capacitor to include the AHO layer of *Chang*, because *Chang*'s AHO film would be used to coat an article in *Conley*, which is not suggested because the technical field of *Conley* is not related to coating a metal article. *Chang* does not disclose another use except coating the surface of a metal article using the AHO film.

In addition, the uppermost layer of the dielectric layer structure disclosed in *Conley* is an AlO film. Accordingly, even if it were possible to replace *Conley*'s aluminum oxides 144 and 144' with *Chang*'s the AHO film (which Applicants do not admit), an AHO film would be in contact with an upper electrode formed on the dielectric layer structure rather than a dielectric film as recited in claim 22. As a result, the combination of *Conley* and *Chang* would not teach or suggest the capacitor

including a dielectric layer which is provided between an AHO layer and an upper electrode as recited in claim 22. See MPEP 2143.01 “If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification”. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

Applicants submit that *Seidl* also fails to cure any of the aforementioned deficiencies of *Conley* and *Chang*. For all of the above reasons, *Conley*, *Chang* and *Seidl*, whether alone or in combination, fail to render obvious the limitations of claim 22.

The Applicants, therefore, respectfully request that the rejection to Claim 22 under 35 U.S.C. § 103(a) be withdrawn.

Lee or Conley in view of Chang and Seidl and Chooi

Claim 23 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over *Lee* or *Conley* each in view of *Chang* and *Seidl* and further in view of U.S. Patent No. 6,486,080 to *Chooi* et al. (hereinafter “*Chooi*”). Applicants respectfully traverse this rejection for the reasons detailed below.

Even assuming *arguendo* that these references could be combined (which Applicants do not admit), the Examiner has failed to show how these references remedy the deficiencies of each of *Lee*, *Conley*, *Chang* and *Seidl* with respect to independent claim 22. Thus, claim 23, dependent on independent claim 22, is patentable over these combined references for the reasons set forth above with respect to independent claim 22.

The Applicants, therefore, respectfully request that the rejection to Claim 23 under 35 U.S.C. § 103(a) be withdrawn.

CONCLUSION

In view of the above remarks and amendments, the Applicants respectfully submit that each of the pending objections and rejections has been addressed and overcome, placing the present application in condition for allowance. A notice to that effect is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to contact the undersigned.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Erin G. Hoffman, Reg. No. 57,752, at the telephone number of the undersigned below.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 08-0750 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

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By

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